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(72) Inventors HANS BEHRINGER, FRANK EDWARD MILLER and ALAN HOURD


## (54) CLOSURES FOR CONTAINERS


(71) We, UNITED GLASS LIMITED, a company organised under the laws of Great Britain, of Kingston Road, Staines, Middlesex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—


The present invention relates to closures for containers, especially to closures which prevent, or render difficult, the undetected opening thereof.

In order to protect the consumer, it is important that tampering with goods packed in containers be discouraged or, at least, be rendered readily detectable. To this end, closures for containers such as bottles are available which are intended to leave, on opening them, a permanent indication that they have been opened, thereby warning the consumer not to accept the container: these are generally termed "pilfer-proof" closures.

A common method of rendering a closure pilfer-proof comprises shrinking a sleeve onto both a container neck and a closure thereon such that the sleeve adheres tightly by friction to the container and the closure. The sleeve is generally of a cellulose material which is shrunk *in situ* by driving off the water content thereof. In order to open the container, it is necessary to cut or tear the sleeve. Whilst this system is generally considered as providing good protection against undetected pilfering, the application of the sleeve and the shrinking thereof involves extra process steps after the closure proper has been applied to the container.

Pilfer-proof plastics caps are known having a lower ring attached to the main cap body by a circumferential line of severable bridges. When applying such a cap to a container, the ring is softened and crimped under an annular bead on the container neck such that it is necessary to break the bridges and thereby detach the ring from the rest of the cap, in order to remove the cap.

The use of the aforesaid plastics cap requires extra steps (heat-softening and crimping) in order to apply the cap to the container. It may also be possible to soften the lower sealing ring by heating and then to prise the ring over the container head to allow opening of the closure, with the possibility of subsequent reforming of the closure, thereby leaving no indication of opening.

The present invention provides an injection-moulded one-piece closure for a container, said closure having a top and a depending skirt comprising an upper skirt portion (adjacent the top) and a lower skirt portion, the lower skirt portion being of a heat shrinkable material.

The preferred embodiment of the invention is a plastics cap having a lower ring attached to the main cap body by a circumferential line of severable bridges, the lower ring being heat-shrinkable. The cap could be located on a necked container by conventional capping techniques and the assembly merely requires heating, for example by blowing with hot air, in order to shrink the ring onto the container neck, preferably below an external annular bead formed on the container neck. It is necessary to break the bridges in order to open the closure.

It will be seen that any attempt to soften the ring by heating will result in the ring tending to shrink further thereby increasing its adhesion to the container.

The ring will generally be formed of a thermoplastic material which has been expanded and thereby pre-stressed to render it heat-shrinkable. The optimum original size and the degree of expansion required can be determined by simple experiment for any particular situation. The cap provides the advantage that no special crimping operation is required in

order to apply it. The cap will generally be supplied to the capping plant in a pre-stressed form. The lower ring, of course, must be thin enough to admit of expanding and prestressing but should not ordinarily be so thin as to render it easily deformable during capping.

Another embodiment of the invention comprises a cap with an elongated skirt, the lower edge of the skirt being heat-shrinkable. The rim portion of the skirt will be normally thinner than the remainder of said skirt and will be expanded to a flared configuration to pre-stress it. On applying heat, the flared portion will shrink inwards to form an internally-directed rim. The closure may be located on the neck of a container in its flared configuration and the lower portion is then heated to form the rim beneath an external annular bead on the container neck. The heat-shrinkable portion may be detachable from the main closure body, for example by means of a shearable connecting membrane.

The closure of the present invention is formed in an injection-blow moulding machine. The appropriate portion of the closure may be rendered heat-shrinkable after moulding by mechanically stressing it with the application of heat. However, it is possible, as will be explained in greater detail hereinafter, to both form and pre-stress a closure in an injection mould.

The present invention further provides a method of sealing a container which comprises applying to the container a closure according to the present invention and subsequently applying heat until the heat-shrinkable portion of the said closure frictionally engages the said container. The present invention also provides containers sealed by a method according to the present invention.

The present invention will now be described with reference to the diagrammatic drawings accompanying the provisional specification, in which:—

Figure 1 shows, in half-section, an exemplary cap according to the present invention,

Figure 2 shows, in half-section, the cap of Figure 1 located on the neck of a container,

Figure 3 shows the cap of Figure 1 at a stage in its manufacture prior to the pre-stressing of the portion thereof to be rendered heat-shrinkable,

Figure 4 shows, in half-section, an exemplary injection mould for the production of the cap of Figure 1, and

Figure 5 shows the mould of Figure 4 at a later stage in the manufacture of the cap, and

Figure 6 is a partially cut-away view of a cap during its manufacture.

As shown in Figure 1, the closure comprises a body 1 having an internal screw thread 2. The cap mouth 3 is defined by a flared skirt portion 4 which is attached to the cap body 1 by means of a circumferential line of bridges 5.

As shown in Figure 2, the cap is applied to a bottle or similar necked container having an external screw thread thereon. The closure may have a disc 6 of resilient material in the roof of the cap in order to provide a liquid-tight seal. Once the cap has been screwed onto the container neck, the skirt portion 4 may be shrunk by applying heat, for example by blowing with hot air, until it frictionally engages the container neck. A bead 7 on the neck of the container will improve the tightness of the engagement.

The cap illustrated in Figure 1 is produced in an injection mould. A suitable mould is shown diagrammatically in Figure 4. This mould comprises a mould shell 8 and a retractable central core 9, said core being surrounded by a first sleeve 10 and a second outer sleeve 11. The cap is moulded initially such that it takes the shape shown in Figure 3, that is with the skirt portion 4 tapering towards the longitudinal axis of the cap.

During this first stage of the manufacture, the first and second sleeves extend along the core as far as the region where the bridge line 5 is formed, the cap body 1 being formed between the core 9 and the shell 8. The skirt portion 4 is formed in a clearance zone 12 between the first and second sleeves 10 and 11.

After the cap body 1 has been formed and while the skirt portion 4 of the cap is at thermoplastic temperature, the outer sleeve 11 is retracted. As the second sleeve 11 is retracted, a fluid pressure, for example that of a gaseous medium such as air, is exerted on the interior of the skirt portion to force it into the flared configuration shown in Figure 1. The first sleeve may be retracted to facilitate the skirt expansion as shown in Figure 5. Vents 13 are provided in the mould shell.

On discharge from the mould, the cap is substantially ready for application to a container by any conventional capping technique.

The temperature within the mould may be controlled on a zone basis in order to provide the optimum temperature conditions for the skirt portion and the cap body. It will be understood that the design of a mould will depend upon the configuration of the cap to be moulded: with some designs it may be possible to dispense with an outer sleeve.

Examples of materials from which the closures of the invention may be made are polyolefins, polyamides, polyesters, polycarbonates, polystyrene and vinyl, acetal, acrylic and cellulosic polymers.

A further method of producing a heat-shrinkable lower portion or skirt in a cap comprises orienting the thermoplastics material, e.g. polypropylene, high-density polyethylene or polystyrene, during injection moulding. Since the thermoplastics injection moulding will undergo maximum shrinkage in the direction along which the material was oriented during its flow into the mould, it is necessary to cause the material to flow, in the skirt region, in a circumferential direction, i.e. a direction transverse to the axis of the cap.

The principle of this embodiment is illustrated diagrammatically in Figure 6 in which is shown a cap having a body 1, an internal screw-thread 2, a mouth 3 defined by a skirt 4 depending from the body 1 and connected thereto by a circumferential bridge line 5.

During moulding, the thermoplastics material is introduced through a slit-like gate 14 of which the long dimension is arranged to be substantially parallel to the axis of the cap, as formed in the mould, and to be substantially co-extensive with the intended longitudinal dimension of the skirt. The thermoplastics material is caused to flow (indicated by arrows a) through the gate whereupon it flows in a circumferential manner (indicated by arrows b) within the mould. It will be seen that the skirt portion of the mould acts, in effect, as a gate for the body portion thereof. Typically, the skirt may be 0.010 inch in thickness whilst the thickness of the cap body, at its minimum, may be 0.060 inch.

Alternatively, it may be desirable to have separate gates for the cap body and skirt respectively. This would ensure that the bridges would not be too tough to break since they would contain the welds between the cap body and the skirt. The use of very cold moulds would provide the maximum moulded-in stress.

The cap, especially the skirt portion, is generally moulded to be oversize to allow for the shrinking operation. However, in some cases, it may be advantageous to have interference between the cap skirt and the bead over which it is to seal; application of heat will then tightly lock the skirt onto the bead.

In addition to the use of hot air or the heat from a flame to shrink the lower portion of a cap of the present invention, an induction heating method may be employed with cap materials containing suitable fillers.

WHAT WE CLAIM IS:—

1. An injection-moulded one-piece closure for a container, said closure having a top and a depending skirt comprising an upper skirt portion (adjacent the top) and a lower skirt portion, the lower skirt portion being of a heat shrinkable material.

2. A closure according to claim 1 in which the lower skirt portion is defined by a heat-shrinkable ring that is attached to the upper skirt portion by severable bridges.

3. A closure according to claim 1 or 2 in which the thickness of the lower skirt portion is less than that of the upper skirt portion and has been expanded into a flared configuration.

4. A closure according to claim 1 in which the lower skirt portion is attached to the upper skirt portion by a shearable connecting membrane.

5. A closure according to claim 1 substantially as herein described and illustrated in the drawings accompanying the Provisional Specification.

6. A method of producing a closure according to claim 1, which comprises forming the closure in an injection moulding machine and rendering at least that portion of the closure defining the lower skirt portion heat-shrinkable by mechanically stressing it, together with the application of heat.

7. A method according to claim 6 in which at least that portion of the closure defining the lower skirt portion is stressed in the moulding machine by expanding it by the application of pressure.

8. A method according to claim 7 in which the pressure is applied by means of a gaseous medium.

9. A method of producing a closure according to claim 1 which comprises forming the closure in an injection moulding machine in which the moulding material forming at least that portion of the closure defining the lower skirt portion is caused to flow into the mould in a direction transverse to the axis of the closure.

10. A method of producing a closure according to claim 1 substantially as herein described and illustrated in the drawings accompanying the Provisional Specification.

11. A closure whenever produced by a method according to any of claims 6 to 10.

12. A method of sealing a container which comprises applying to the container a closure according to any of claims 1 to 5 and 11 and subsequently applying heat until the heat-shrinkable portion of the closure frictionally engages the container.

13. A method according to claim 12 in which the heat is applied by blowing the closure with hot air.

14. A container when sealed by a method according to claim 12 or 13.

For the Applicants,
CARPMAELS & RANSFORD,
Chartered Patent Agents,
43 Bloomsbury Square,
London WC1A 2RA.

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1384370 PROVISIONAL SPECIFICATION
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

FIG.1

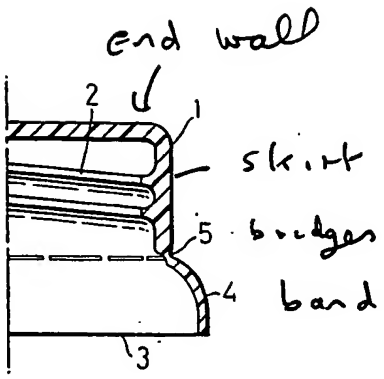



FIG.2

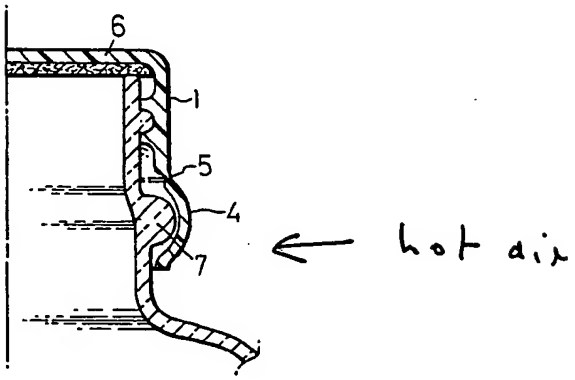
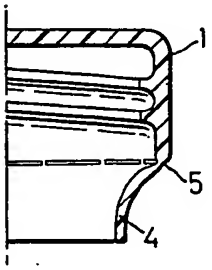



FIG.3



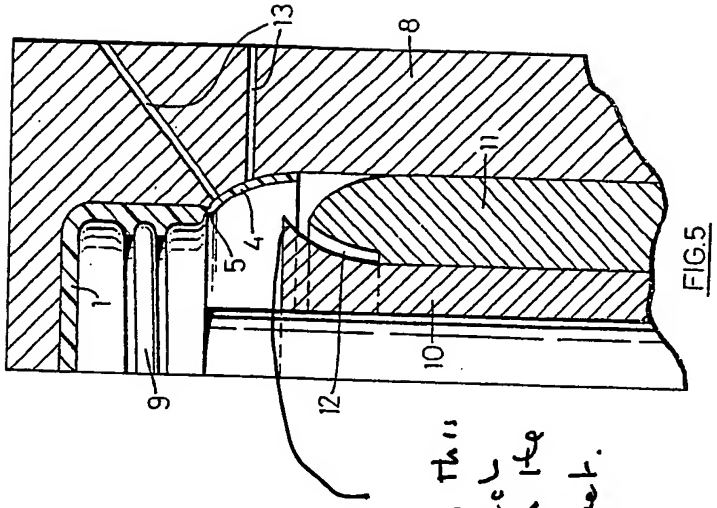



FIG.5

how does this differ from the prior product.

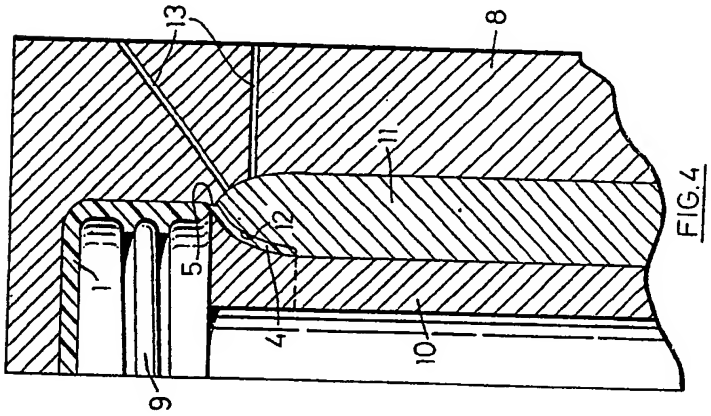



FIG.4

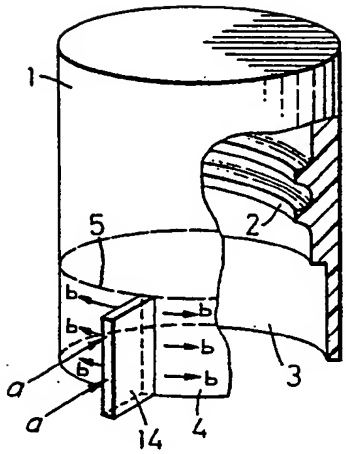



FIG. 6